

**A SUCCESSFUL INTERVENTION PROGRAM FOR
HIGH ABILITY MINORITY STUDENTS**

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Among professional occupations in the United States, non-Asian minorities are least represented in science and engineering fields. Minorities represented at least 20% of the total population, but less than 2% of the doctoral degrees in science and engineering are awarded to non-Asian minorities. If we trace the process that produces Black, Hispanic, and Native American scientists and engineers back one step further, we continue to find underrepresentation. Within the college-age population, blacks make up 14%, Hispanics constitute 6.4% and Native Americans constitute 0.6%. However, only 5% of the full-time college students majoring in engineering are Black, only 4.5% are Hispanic, and only 0.4% are Native American (Engineering and Manpower Commission 1987). The Bureau of Labor Statistics predicts that over the next decade, civilian employment of scientists and engineers has the potential to grow by 40%. Further, projections for the year 2000 indicate that 100,000 fewer B.S. and B.A. degrees will be awarded than were awarded in 1984 (Devarics 1987). The latter projection takes into consideration the overall declining proportion of all 18-year old college students. Within this shrinking pool of 18-year old potential college students will be an increasing proportion of Blacks and Hispanics. In order to change the educational patterns for minority youth, we must take an intense look at the factors that affect the science and mathematics performance of minorities. Further, we must examine and document, with the intent of replicating, the work of programs that are successful at producing minority scientists and engineers. The fundamental concern at this time appears to be the quality of precollege experience because research has shown that lack of precollege preparation is the single most important cause of underrepresentation of minorities in science and engineering careers. For many years, intervention programs have attempted to improve the quality of the minority precollege experience by latter year intervention in grades eleven and twelve. Later efforts, such as this one, have concentrated on earlier years. The vast majority of these programs have operated with little or no emphasis placed on the formal evaluation of their efforts. Casual evaluations (e.g., George 1987; Wellington 1984), however, have shown that many of the students involved in such programs have gone on to pursue studies in quantitative fields. That intervention programs are effective is widely accepted but not rigorously documented. The mechanisms these programs have developed need to be identified and their potential for broader use evaluated. The ultimate goal of such studies would be to provide the different educational communities with a set of proven cost-effective state-of-the-art mechanisms designed to increase participation and success of minority students in science and mathematics-related courses. One such intervention program is the Saturday Academy program for high ability minority students in the Washington, D.C. area. The purpose of this study is to provide a description of the Saturday Academy with the intent of making it available to personnel who are considering the development of similar projects and to examine the effect of participation in the program on high school graduation rates, college enrollment and choice of quantitative major.

Description of the Saturday Academy Program

Located on the campus of the University of the District of Columbia the program operated in 1987-88 on a direct cost budget of \$68,063, funded primarily by the National Aeronautics and Space Administration (NASA), and serviced 282 students (approximately \$242 per student). Participants are students who have been identified as academically talented, primarily seventh, eighth, and ninth graders from the metropolitan Washington, D.C. area. To be selected for this program, first students must have an overall B-average or better. Second, the students must be recommended by their math/science teacher or counselor. Third, students must have a parent or guardian willing to attend two Saturday sessions and an orientation session. Finally, the student must agree to the program's mandatory attendance requirements - more than one unexcused absence results in dismissal from the program. The Saturday Academy is designed to provide enrichment experiences for academically talented minority youth without cost to them. These experiences are in creative mathematics, electrical engineering, and computer science. The program has been in existence since September 1982.

Electrical Engineering Component

The engineering component is designed to introduce the participants to the world of electrical engineering in an organized scientific manner. For the most part this is accomplished by first introducing basic theory of electricity in terms of current and voltage and the instruments that measure these quantities. Secondly, the various components used in electrical construction are introduced through theory and observation. Students are also given specific instruction in soldering, reading schematic diagrams, and in identifying components such as resistors, diodes, capacitors, integrated circuits and transistors. They then go on to construct light generators, sound generators and/or transistor radios and robots.

Computer Science Component

The computer science component is designed to help program participants become computer literate. Most participants do not have access to personal computers at home and have limited access at their regular schools. Instruction begins with teaching the present limitations of the computer and its internal structure. Participants learn to program in BASIC; they access the university's Vax 8650, Vax 11-780 or IBM 4341 with a modem or by direct link. IBM PC's are also available to participants. More advanced students are instructed in PASCAL.

Mathematics Component

This component provides students with abstract and semi-abstract experiences in what the program calls non-numerical mathematics. The end result of such experiences is designed to be the student's acquisition of application, analysis, and synthesis skills. All students work with group tables and the construction of mathematical systems. They learn operations in bases other than base 10, 3-dimensional explorations, and basic set theory. Advanced students study trigonometric and geometric concepts.

Evaluation

In an attempt to evaluate the Saturday Academy Program, all persons involved were given an opportunity to give input. Parents (or guardians) of the current participants, participants, and program teachers were asked to complete questionnaires. Administrative personnel were interviewed and project reports were examined. Results of these surveys and interviews will be made available during the actual presentation. Also included in the evaluation were alumni of the Saturday Academy Program. Eighth and ninth grade participants in the 1982 program and ninth grade participants in the 1983 program formed the experimental population. There were 180 students in the population. Of the 180 students, 69 students were still living at the same address and/or still had the same telephone number as when they were participants in the program or were accessible through other accessible participants. The experimental group was made up of these 69 Saturday Academy alumni. Telephone contact was made with the homes of each of the 69. If the former participants were not available, information was obtained from parents or guardians; information was not accepted from siblings or others. Questions, read from a prepared survey form, were asked about high school graduation, enrollment in college and choice of college major. One hundred and thirty four students were in the control population. All control population students were ninth graders in 1983. They were identified as having the same profile as the Saturday Academy participants with regard to performance in high school course work and recommendations of teachers and/or counselors. No parental participation was required of the control group; this factor may have an effect which limits the generalizability of this study. Of the 134 control population students, 50 (37%) were still living at the same address and/or still had the same telephone number as they had in 1983 or were accessible through other accessible control group students. The control group was made up of these 50. Control group students were contacted by telephone in the same fashion as were the experimental group members. A tally was kept on the number of each students in each group completing high school, enrolling in college and choosing a quantitative major. The results are given below.

The program had a significant effect on the three variables; the effect was, however, more pronounced for males than for females.

VARIABLES	Experimental Group vs. Control Group		
	EXPERIMENTAL P ₁	CONTROL P ₂	DIFFERENCE P ₁ - P ₂
high school graduation	.99	.76	.23
college enrollment	.91	.46	.45
quantitative major	.45	.20	.25

Discussion

Several common themes emerged in the evaluation by the various groups: the effectiveness of hands-on activities, the necessity for improvement in some aspects of instruction, the desirability of including career information and field trips. Parents mentioned that more black males should be recruited, a particularly crucial factor given the success of the program with males. The study of the alumni of the program shows that it was successful in improving high school graduation rates, college enrollment rates, and the rate of selection of a quantitative major. The program had substantially greater effect on male participants than on female participants. Moreover, substantially more than half of the participants were female. This highlights a feature that distinguishes the participants of this program from the white participants of most science and mathematics programs in the United States, where generally females are underrepresented. Colleges and universities sometimes see intervention programs as recruitment devices. Thus it is of interest to note that of the students in this study (experimental and control), thirteen chose to attend the University of District of Columbia. Nine of these 13 were Saturday Academy alumni. The results of this investigation serve to document the success which this intervention program has enjoyed with respect to encouraging non-Asian minority students to prepare themselves for quantitative careers. It is not possible to point to an intervention program that can trace its successful influence through the participants' sophomore year in college. Further research, however, is needed to track these same students through their college graduation and into graduate school and/or careers. Such studies would then determine the proportion of intervention programs students that i) graduate from college; ii) graduate with a quantitative degree; iii) complete a graduate degree; iv) complete a graduate degree in a quantitative field; and v) enter a career field requiring quantitative expertise. In-depth interviews with alumni who chose quantitative majors should inquire as to whether they found some part of the Saturday Academy program particularly helpful. Longitudinal studies of later alumni are also needed; the program should encourage all alumni to continue their contact throughout their college studies.

Research is also needed with controls for the parental involvement factor. Other influential variables to be studied include the students' academic performance and socio-economic factors.

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